A KEY TO THE DRAGONFLIES (ODONATA) OF SOUTH-WESTERN AUSTRALIA

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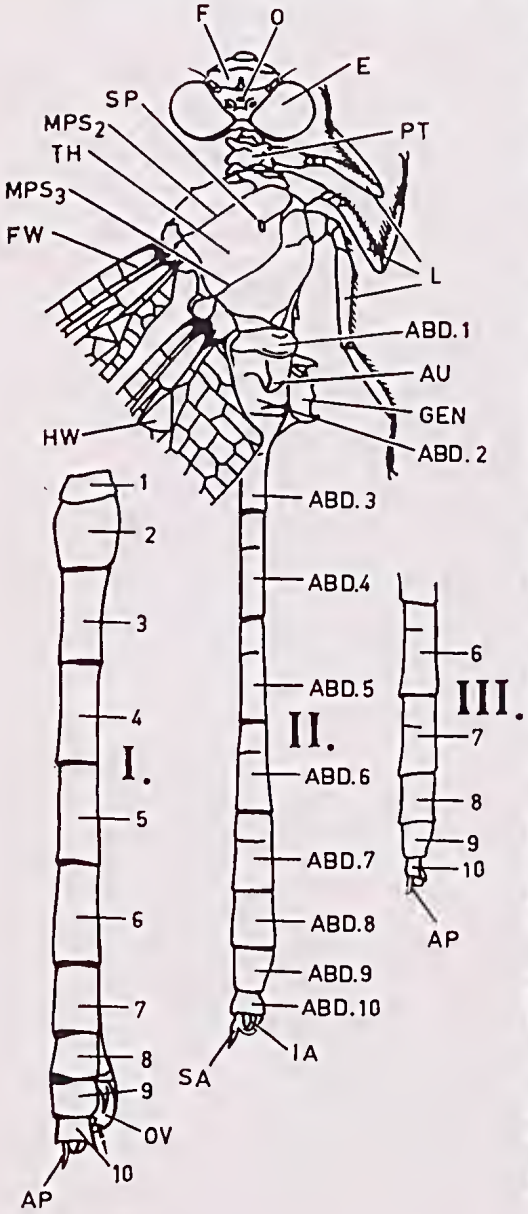
INTRODUCTION

There are only two comprehensive accounts of the Odonata of South-Western Australia and these papers, published half a century ago, are not only out of date but are also inaccessible to the naturalist. Tillyard (1908) laid the foundations of future study with an annotated list of 26 species, while Ris (1910) identified the collections of the Hamburg Expedition of 1905 and discussed all the dragonflies recorded from Western Australia to that time. He included three species not mentioned by Tillyard, but the occurrence of these is open to considerable doubt. Records of Western Australian specimens of *Acanthaeshna inermis* (Martin) and *Procordulia jacksoniensis* (Rambur) were disputed on ecological and zoogeographical grounds by Tillyard (1911, 1916) and were ascribed to false labelling. Further, Ris misidentified two female specimens of *Austrolestes annulosus* (Selys) as *A. leda* (Selys), a species ranging in distribution from Queensland to eastern South Australia (Watson, unpubl.). Subsequent collecting in this state has failed to show the presence of these three otherwise eastern Australian dragonflies, which are omitted from this key.

Since the publication of Ris' paper, a further eight species have been recognised from the south-west and it seems probable that others await discovery. The incorporation of the known species into a key will, it is hoped, enable naturalists to recognise adult dragonflies collected in the area between the mouth of the Murchison River and Esperance. However, as the key is constructed on a systematic basis, it will also act as a guide to the relationship of new species which may be discovered. As yet, there are insufficient data on larvae to frame a comprehensive key, but such a key will be published later when larval growth sequences are better known.

The technical terms used are illustrated in the explanatory figures and in the plates. Only plate references are given in the text; in doubtful cases, further reference should be made to the explanatory figures.

The sexes of dragonflies may readily be distinguished through the presence of complex accessory genitalia on the ventral surface of the second abdominal segment of the male, structures which are absent in the female. Further, the females of all Zygoptera (damsel flies) and of the Aeshnidae and Petaluridae of the Anisoptera (dragonflies proper) have well developed ovipositors, used for laying eggs in the tissues of aquatic plants. Despite the accepted common belief, dragonflies can be handled with safety as they have no sting and, although the jaws of larger species are sharp and powerful, they are not dangerous.



AA = Anal area.
ABD = Abdominal segments.
AC = Anal crossing.
AH = Angulated hindwing.
AL = Anal loop.
AN = Antenodal spaee. (1 and 2) = 1st and 2nd series of antenodal eross veins.
AP = ♀ anal appendage.
AR = Arculus.
AS = Seetors of areulus.
AU = Auriele.
E = Eye.
F = Frons.
FL = Foreleg.
FW = Forewing.
GEN = ♂ seeondary genitalia.
HS = Humeral stripe.
HW = Hindwing.
IA = ♂ inferior appendage.
IR_2, IR_3 = Veins of radial seetor.
L = Legs.
ML = Mid-leg.
MPS_2 = Mesothoraeic pleural suture.
MPS_3 = Metathoraeic pleural suture.
MS = Median spaee.
N = Nodus.
O = Ocelli.
OV = Ovipositor.
P = Pterostigma.
PR = Process on hind border of eye.
PT = Prothorax.
Q = Quadrilateral.
R_2, R_3 = Veins of radial seetor.
SA = ♂ superior appendage.
SP = Spiraele.
SS = Supplementary seetors.
T = Triangle.
TH = Thorax.
TK = Tibial keel.

Right lateral views of;

I. *Acanthaeshna anacantha* ♀, abdomen. (Ovipositor present.)
II. *Austrogomphus lateralis* ♂. (Head turned to right.)
III. *Austrogomphus lateralis* ♀, end of abdomen. (Ovipositor absent.)

KEY

1. a. Wings similar in shape and venation, petiolate, generally held above body at rest (exeept *Argiolestes)*; diseoidal eell a simple quadrilateral (fig. 1: Q); slim inseets—Damselflies.

Sub-Order ZYGOPTERA 2

b. Wings generally dissimilar in shape and venation, not petiolate, held extended at rest; diseoidal cell divided into triangle and hypertriangle (figs. 3-5: T); stouter inseets—Dragonflies.

Sub-Order ANISOPTERA 11

2. a. No supplementary seetor veins in wings (fig. 1).

Family COENAGRIIDAE 3

b. Supplementary seetors present in wing (fig. 2: SS) 6

3. a. No "T" mark in front of oeelli;
♂: With two pale spots behind eyes.
♀: With spine on Abd. 8 ventrally; sometimes with pale spots behind eyes.

Ischnura 4

b. Pale band above frons with flattened "T" mark in front of oeelli (fig. 8);
♂: With transverse pale band behind eyes.
♀: Without spine on Abd. 8 5

4. a. ♂: With Abd. 2-6 bright red, the rest blaek, tipped blue.
♀: Dimorphic;
i. Similar to ♂.
ii. Greenish bronze above, pale below.
Small speeies (length 21-28 mm.).

I. aurora (Brauer)

b. ♂: Abd. 1-2 green-blue and metallie black;
3-7 metallie green-blaek above, pale below;
8-9 blue.
♀: Dimorphic;
i. Similar to ♂.
ii. Dull blaek above, pale below; often with grey pruineseenee so that inseet appears bluish.
Larger speeies (length 30-35 mm.).

I. heterosticta (Burmeister)

5. a. Anal erossing nearer the basal antenodal eross vein (fig. 1: AC).
♂: Briek red, with abdomen blaek distally and a blue tip.
♀: Reddish and blaek-bronze; frons pale with dark markings.

Xanthagrion erythroneurum Selys

b. Anal crossing midway between antenodal eross veins. Both ♂ and ♀ blue and blaek-bronze; ♀ duller, with frons mainly blaek (fig. 8: F).

Austroagrion coeruleum (Tillyard)

6. a. Origin of IR_3 closer to nodus than to arculus (cf. fig. 2: IR_3, N, AR).

Family MEGAPODAGRIIDAE, *Argiolestes* 7

b. Origin of IR_3 closer to arculus than to nodus (fig. 2: IR_3, N, AR).

Family LESTIDAE, *Austrolestes* 8

7. a. Thorax metallic green-black and white, the line of junction passing diagonally from mid-leg to hindwing (fig. 22); length 29-36 mm.

♂: Superior appendages with small, subterminal ridge; inferior appendages strongly divergent at tips, approximately 1-3rd as long as superior (fig. 27).

A. minimus Tillyard

b. Line of junction between light and dark areas of thorax following metathoracic pleural suture; a vertical white stripe above mid-leg (fig. 23); length 22-30 mm.

♂: Superior appendages with large single or double subterminal spine; inferior appendages very short, not greatly divergent (fig. 29).

A. pusillus Tillyard*

8. a. Broad dorsal blue or pinkish stripe along Abd. 2.

♂: Superior appendages without basal process (figs. 24, 25; SA). 9

b. No broad longitudinal stripe on Abd. 2.

♂: Superior appendages with basal process (fig. 26: BP). 10

9. a. Anal crossing of forewing between two antenodal cross veins (cf. figs. 1, 2: AC, AN).

♂: Superior appendages long, inferior short (fig. 25); Abd. 10 blue or whitish above.

A. analis (Rambur)

b. Anal crossing of forewing level with or basal to basal antenodal cross vein (cf. figs. 1, 2: AC, AN).

♂: Inferior appendages almost ½ as long as superior (fig. 24); Abd. 9 and 10 blue above.

A. aridus (Tillyard)

10. a. Abd. 1 with lateral light area enclosed in dark ring (fig. 9); humeral stripe not extended beyond mesothoracic pleural suture.

♂: Abd. 2 with variable dark basal band and wider dark distal band, which may join in the mid-line (fig. 7); Abd. 3-7 with dark arrow-shaped dorsal marks over distal two-thirds, blue basally and laterally; Abd. 10 black above.

A. annulosus (Selys)

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* *A. pusillus* includes *A. pusillissimus* (Kennedy), a name which has been given to the single spined morph. Whether or not the two morphs are valid species is uncertain.

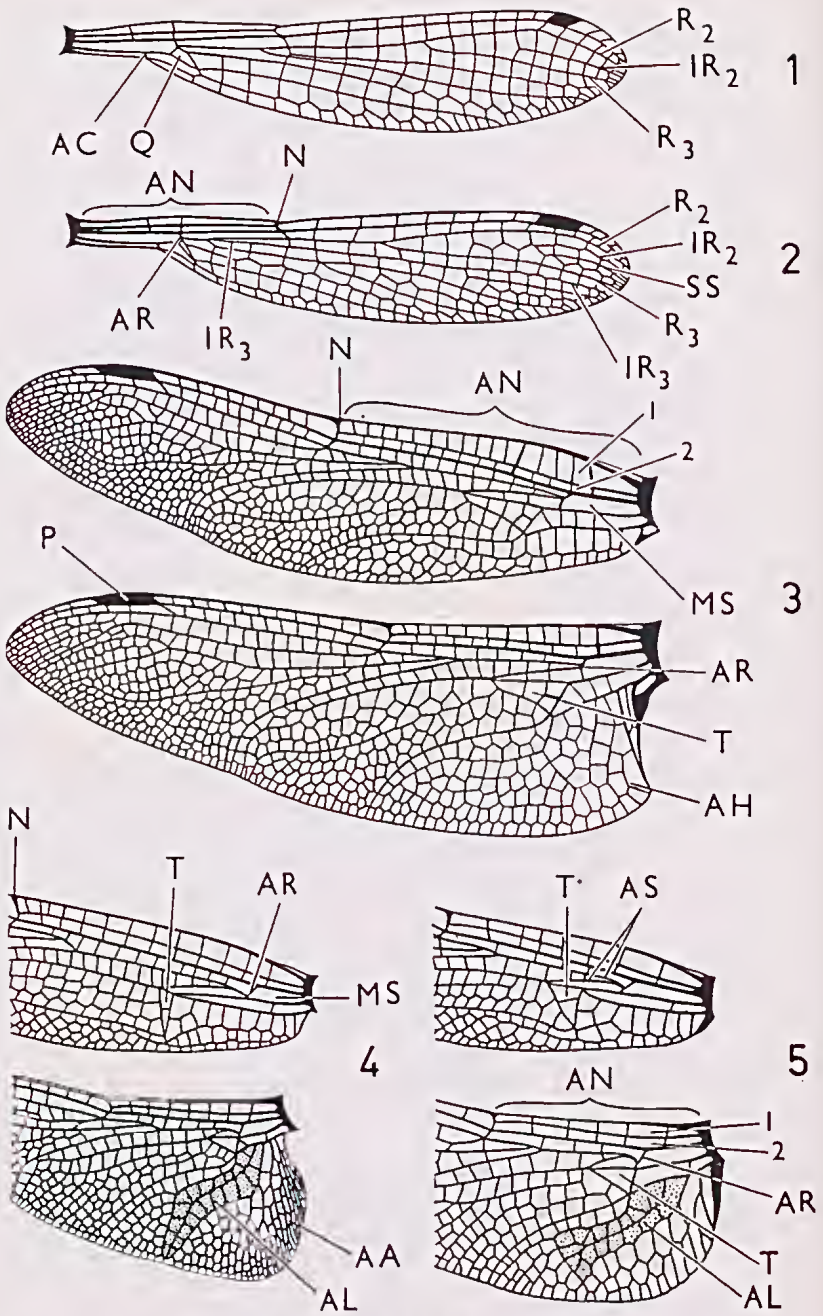

PLATE I

Fig. 1.—*Xanthagrion erythroneurum*, forewing. Fig. 2.—*Austrolestes psyche*, forewing. *Fig.* 3.—*Aeshna brevistyla*, fore- and hindwing. Fig. 4.—*Pantala flavescens*, base of fore- and hindwing. Fig. 5.—*Hemicordulia tau*, base of fore- and hindwing.

b. Abd. 1 without dark ring laterally; humeral stripe with small extension past mesothoraeic pleural suture (fig. 21: HS).
♂: Abd. 2 dark above, with pale narrow mid-dorsal line over distal half (fig. 10); Abd. 10 blue above.
A. io (Selys)

e. Abd. 1 without dark ring laterally; humeral stripe without extension past mesothoracie pleural suture (fig. 20: HS).
♂: Dorsal dark area of Abd. 2 eonstrieted centrally (fig. 11); Abd. 3-7 blaek above, with narrow, blue basal bands; Abd. 10 blaek above.
A. psyche (Hagen)

11. a. Triangles of fore- and hindwings more or less equidistant from arculus (exeept in *Petalura*, which has the median spaee free of cross veins) (fig. 3: T, AR, MS); first and seeond series of antenodal cross veins not substantially eoineiding (fig. 3: AN 1 and 2).
Super-Family AESHNOIDEA 12

b. Triangle mueh closer to areulus in hindwing than in forewing (figs. 4, 5: T, AR); first and seeond series of antenodal eross veins substantially eoineiding (marked diserepaneies may oeeur in *Synthemis*, but, in this genus, the median spaee has eross veins) (figs. 4, 5: AN 1 and 2).
Super-Family LIBELLULOIDEA 16

12. a. Eyes touehing in mid-line; ♀ with ovipositor.
Family AESHNIDAE 13

b. Eyes separated; ♀ with or without ovipositor 14

13. a. Blaek, with eream spotting on thorax and abdomen.
♂: Anal border of hindwing angulated (ef. fig. 3: AH).
Acanthaeshna anacantha (Tillyard)

b. Dark brown, with two pale stripes on side of thorax.
♂: Anal border of hindwing angulated (fig. 3: AH).
Aeshna brevistyla Rambur

e. Pale brown with darker patterning. Thorax dull brown, with yellowish spots above insertions of legs.
♂: Anal border of hindwing rounded.
Anax papuensis (Burmeister)

14. a. Large species, more than 100 mm. aeross wings.
♂: With leaf-like superior appendages (fig. 28: SA).
♀: With an ovipositor.
Family PETALURIDAE
Only one speeies .... *Petalura hesperia* Watson

b. Small species, ea. 50-60 mm. across wings.
♂: Without petaloid appendages.
♀: Without an ovipositor.
Family GOMPHIDAE 15

PLATE II

15. a. Thorax yellow laterally, almost free of dark markings.
♂: Abd. 4-7 black, with two large yellow basal spots nearly meeting dorsally.
♀: Abd. 4-7 with both basal and apical spots (fig. 14); no tubercles on head.
Hemigomphus armiger (Tillyard)

b. Thorax yellow laterally, with black in sutures and around spiracle. Abd. 3-6 yellow dorsally, with black laterally and a black distal band (fig. 12).
♀: With three tubercles on back of head, between eyes.
Austrogomphus collaris Selys

c. Thorax cream and lilac laterally, with brown in sutures and around spiracle. Abd. 3-6 dark brown, with yellow basal spots and smaller yellow central spots, both pairs nearly meeting dorsally (fig. 13).
♀: Without tubercles on head.
Austrogomphus lateralis (Selys)

16. a. Median space with cross vein.
Sub-Family SYNTHEMINAE, *Synthemis* 17

b. Median space without cross vein (fig. 4: MS) 18

17. a. Four pale spots on anterior aspect of thorax in both ♂ and ♀; length 55-58 mm.
♂: Abd. dark brown or black with creamy spots; superior appendages fig. 32.
♀: Duller.
S. leachii Selys

b. Two small round yellow spots on anterior aspect of thorax in both ♂ and ♀; abdomen black with yellowish spots.
♂: Superior appendages generally similar to *S. leachii*, but only slightly longer than inferiors; length 53 mm.
S. spiniger Tillyard

c. Two broad, pale greenish, grey-yellow stripes on anterior aspect of thorax; abdomen black or brown, greenish spots; length 38-40 mm.
♂: Superior appendages fig. 31.
S. cyanitincta Tillyard

PLATE II

Fig. 6.—*Austrolestes analis* ♂, Abd. 2 from above. Fig. 7.—*Austrolestes annulosus* ♂, Abd. 2 from above. Fig. 8.—*Austroagrion coeruleum* ♀, face from above. Fig. 9.—*Austrolestes annulosus* ♀, Abd. 1 from side. Fig. 10.—*Austrolestes io* ♂, Abd. 2 from above. Fig. 11.—*Austrolestes psyche* ♂, Abd. 2 from above. Fig. 12.—*Austrogomphus collaris* ♂, Abd. 4 from above. Fig. 13.—*Austrogomphus lateralis* ♂, Abd. 4 from above. Fig. 14.—*Hemigomphus armiger* ♀, Abd. 4 from above. Fig. 15.—*Procordulia affinis* ♂, Abd. 2 from above. Fig. 16.—*Hemicordulia australiae* ♀ Abd. 5 from above. Fig. 17.—*Procordulia affinis* ♂, Abd. 5 from above. Fig. 18.—*Synthemis cyanitincta* ♂, tibia and tarsus of prothoracic leg. Fig. 19.—*Hesperocordulia berthoudi* ♂, head from side.

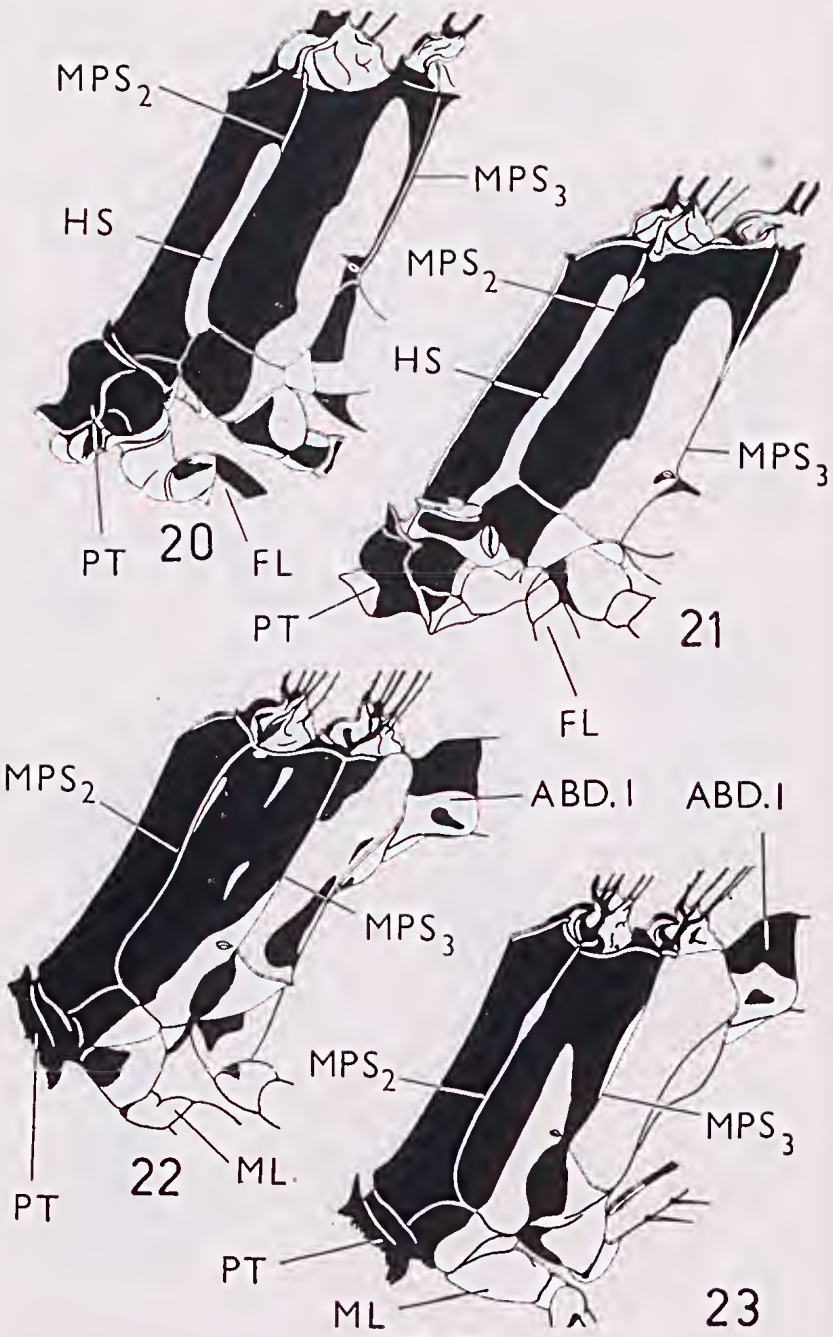

PLATE III

Fig. 20.—*Austrolestes psyche* ♀, thorax from side. Fig. 21.—*Austrolestes io* ♀, thorax from side. Fig. 22.—*Argiolestes minimus* ♂, thorax from side. Fig. 23.—*Argiolestes pusillus* ♂, thorax from side.

d. Thorax brown, with dark patch on anterior surface; abdomen reddish brown with pale spots; length 48-55 mm.
♂: Superior appendages fig. 30.
S. macrostigma occidentalis Tillyard

18. a. Hindwing without continuous mid-vein to distal end of "toe" in anal loop of local species (fig. 5: AL, stippled area); small lobe on central hind border of eye (fig. 19: PR); triangle of forewing not elongated (fig. 5: T).
♂: With keel on inner edge of tibia of foreleg (fig. 18: TK).
Sub-Family CORDULIINAE 19

b. Hindwing with anal loop well developed, strong mid-vein to distal end of "toe" (loop indistinct in *Nannophya*) (fig. 4: AL, stippled area); no lobe on hind border of eye (except *Austrothemis*); triangle of forewing elongated (not greatly so in *Nannophya* and *Austrothemis*).
♂: Without tibial keel.
Sub-Family LIBELLULINAE 23

19. a. Basal side of triangle of hindwing distal to arculus, but may be very close to it 20

b. Basal side of triangle of hindwing never distal to level of arculus (fig. 5: T, AR) 21

20. a. Both ♂ and ♀ banded black and reddish.
Hesperocordulia berthoudi Tillyard

b. Uniform brownish black, with metallic green reflections. ♀: Duller.
Lathrocordulia metallica Tillyard

21. a. ♂: Auricles present (fig. 15: AU); superior appendages strongly arched (fig. 34).
♀: Very similar to *Hemicordulia australiae* (q.v.) but may be distinguished by the absence of a black lateral stripe on Abd. 3, the brown pterostigma, and the colour pattern of the abdominal segments (figs. 16, 17).
Procordulia affinis (Selys)

b. ♂: Auricles absent; superior appendages not as (a).
♀: Black stripe along the lateral edge of Abd. 3 (may not be prominent in *Hemicordulia australiae*).
Hemicordulia 22

22. a. Black "T" mark on frons; pterostigma brown (cf. fig. 3: P).
♂: Superior appendages with sharp apices curled upwards (fig. 35).
H. tau Selys

b. Metallic green mark on frons; pterostigma black.
♂: Superior appendages with large medio-ventral spine (fig. 33).
H. australiae (Rambur)

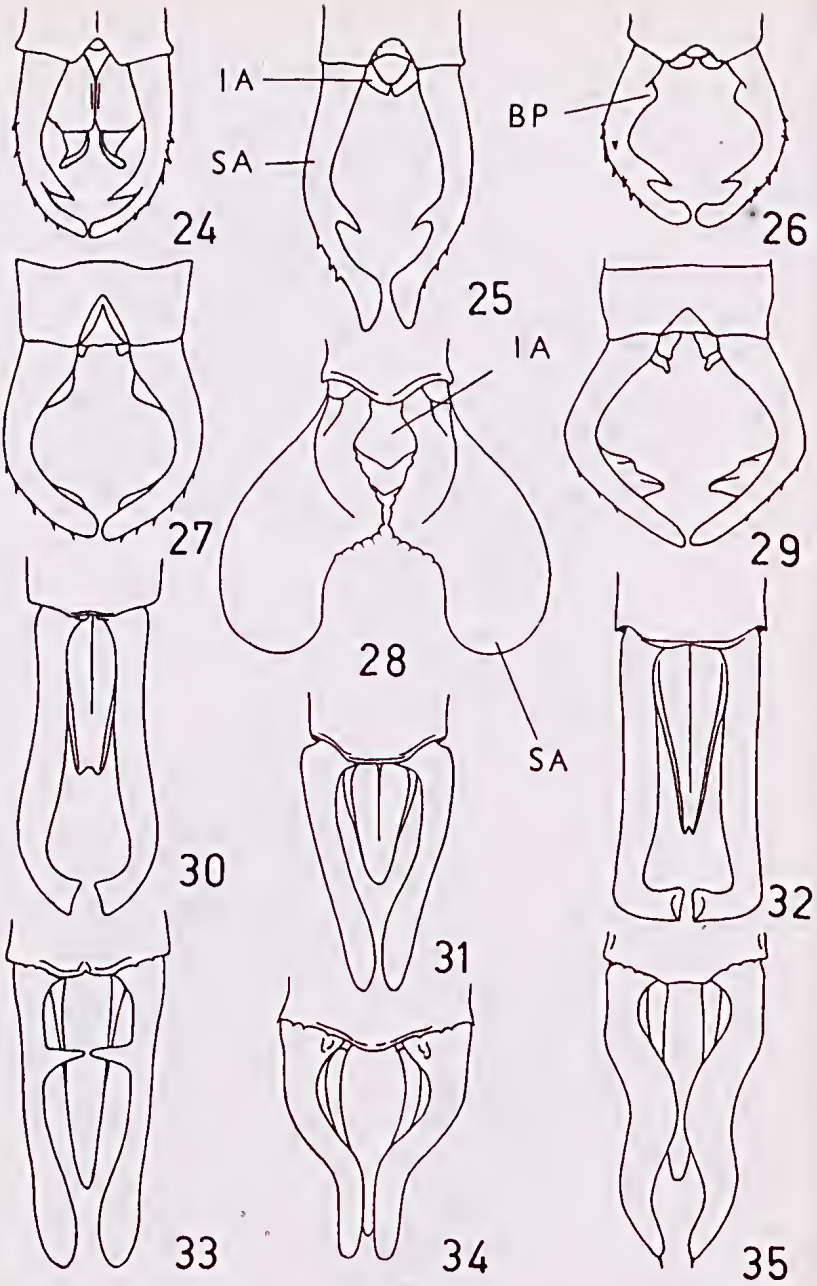

PLATE IV

Male appendages—from above.

Fig. 24.—*Austrolestes aridus*. Fig. 25.—*Austrolestes analis*. Fig. 26.—*Austrolestes annulosus*. Fig. 27.—*Argiolestes minimus*. Fig. 28.—*Petalura hesperia*. Fig. 29.—*Argiolestes pusillus*. Fig. 30.—*Synthemis macrostigma*. Fig. 31.—*Synthemis cyanitincta*. Fig. 32.—*Synthemis leachii*. Fig. 33.—*Hemicordulia australiae*. Fig. 34.—*Procordulia affinis*. Fig. 35.—*Hemicordulia tau*.

23. a. Triangle of forewing not greatly elongate 24
b. Triangle of forewing greatly elongate and narrowed (fig. 4: T) 25

24. a. Sectors of areulus fused for some distance (cf. fig. 5: AS); very small forms, ca. 30-40 mm. across wings.
Nannophya dalei occidentalis (Tillyard)
b. Sectors of arculus not fused; broad bodied forms, red and black or yellow and black, ca. 50-60 mm. across wings.
Austrothemis nigrescens (Martin)

25. a. Last antenodal cross vein of forewing complete (cf. fig. 5).
♂: Bright powder blue when mature.
♀ and young ♂: Yellow and black, becoming blue when old.
Orthetrum caledonicum (Brauer)
b. Last antenodal cross vein of forewing incomplete, only the first series represented (fig. 4) 26

26. a. Anal area of hindwing normal; small dragonflies, ca. 50-65 mm. across wings.
Diplacodes 27
b. Anal area of hindwing greatly enlarged (fig. 4: AA); dragonflies ca. 75 mm. across wings 28

27. a. ♂: Abdomen red or yellowish, with small paired black markings on either side of mid-line of 3-7.
♀: Duller, with yellow pigmentation at bases of hindwings.
D. bipunctata (Brauer)
b. ♂: Abdomen pure scarlet, or yellowish, with at most some black marks on Abd. 1-3 and 8-10.
♀: Duller, marked with black on abdomen; wings clear or with yellow pigmentation at tips.
D. haematodes (Burmeister)

28. a. Broad reddish spot at base of hindwing; body red.
Tramea eurybia Selys
b. Yellow saffroning at base of hindwing; body yellowish, or orange red above, with black markings on Abd. 8-10 dorsally.
Pantala flavescens (Fabricius)

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FROM FIELD AND STUDY

White Ibis near Bunbury.—On March 22, 1957, while passing the lagoons situated on the Perth side of the Preston River bridge, between Picton and Bunbury, I saw two White Ibis feeding not more than 30 yards from the roadside. Previous Bunbury district records, since the initial invasion in 1952, are given in the *W.A. Nat.*, 5: 45 and 119.

—S. R. WHITE, Floreat Park.

White Ibis in the Wheatbelt.—Since the original invasion of the White Ibis *(Threskiornis aethiopica)* into the South-West in 1952 (*W.A. Nat.*, 3: 184) almost all of the records have been from coastal districts between Perth and Busselton. However, there are now two observations of the species in more inland localities. On December 16, 1957, Fauna Warden S. Bowler saw two White Ibis at Toolibin Lake, via Narrogin. On January 22, 1958, with members of the State Fauna Protection Advisory Committee on tour S. Bowler and I saw one White Ibis at "Nagel's," a freshwater swamp alongside the Katanning-Pingrup Road, and four miles beyond Lake Ewlymartup. At the same swamp were a White Egret and several White-faced and Pacific Herons.

—D. L. SERVENTY, Nedlands.

White and Glossy Ibis at Fremantle.—The White Ibis *(Threskiornis aethiopica)* is a recent arrival into the South-west (D. L. Serventy, *W.A. Nat.*, 3: 184), having been recorded at Fremantle, Coolup, Bunbury and Busselton. I have registered the species in the Fremantle district on three occasions—in January and February, 1956 (*W.A. Nat.*, 5: 138), in February, 1957, and in January, 1958. On the second occasion, P. S. Stone and I observed an individual at Bibra Lake, and on the latter, I saw a group of four at the same locality. Apparently the species wanders into this region when smaller lakes and swamps of the South-West have largely evaporated.